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EXAMINER	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/786,280
Filing Date: February 24, 2004
Appellant(s): WALEH ET AL.

David W. Collins
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 11/12/08 appealing from the Office action mailed 6/12/08.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,037,506	GUPTA et al	8-1991
3,893,869	MAYER et al	7-1975
5,114,834	NACHSHON	5-1992

5,531,857	ENGELSBERG et al	7-1996
5,643,472	ENGELSBERG et al	7-1997
5,024,968	ENGELSBERG	6-1991
WO 97/17164	LIVSHITS et al	5-1997
WO 95/07152	ELLIOTT et al	3-1995

ENGELSBERG, A. C. "Laser-Assisted Cleaning Proves Promising" Precision Cleaning, 1994, pp 154-159

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-4, 6, 7,11-14, 18-25 and 29-30 rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US Patent No 5,037,506) in view of Mayer et al (US Patent No 3,893,869) and further in view of Nachshon (US Patent No 5,114,834), Egelsberg (Laser-Assisted Cleaning Proves Promising), WO 97/17164, WO 9507152, Engelsberg et al (US Patents 5,643,472 and 5,531,857) and Engelsberg (US Patent No 5,024,968).

Gupta et al teach a method substantially as claimed except for the last laser cleaning step and the use of ultrasonic/megasonic during the solvent treatment.

The method comprises removal of organic materials including coatings, layers and photoresists from semiconductor substrates (including silicon wafers) by application of gaseous sulfur trioxide (column 2, line 32 – column 3, line 2, column 4, lines 16-50), followed by a solvent rinse with claimed solvents (column 4, lines 51-57).

Gupta et al teach temperatures as claimed (column 4, lines 44-46).

Gupta et al teach application of sulfur trioxide to a photoresist to which UV radiation was applied. See at least column 5, lines 22-32, column 2, lines 39-49 and Description of the Related art.

Gupta et al do not specifically teach application of laser cleaning after the rinsing step.

However, precise cleaning and photoresists removal by lasers was conventional in the art, as evidenced by Nachshon, Egelsberg, Egelsberg et al, WO 97/17164, and WO 95/07152.

Nachshon teaches that residual photoresist contamination may exist after chemical removal of the photoresists (column 1, lines 55-64) and teaches removal of photoresists by pulsed laser (column 2, line 33 – column 3, line 60). Nachshon teaches that laser cleaning can be conducted after, before or during the reactive cleaning (column 3, lines 52-56).

Livshits et al (WO 97/17164) teach that methods of wet and dry stripping of photoresists, including the stripping with organic solvents, are not complete and may cause contamination (page 1, last paragraph – page 3 first paragraph). Livshits et al teach application of laser energy to remove photoresists (column 4, last paragraph - column 5, first two paragraphs, Summary of the Invention).

Engelsberg et al (5,531,857) that wet chemical cleaning fails to completely remove particulates (column 1, lines 56-59) and teach application of laser energy to solve the problem (Summary of the Invention).

Engelsberg et al (5,643,472) teach that wet and vapor cleaning methods have several drawbacks including inability to remove small particles (column 2, lines 50-56) and teach application of laser energy to solve the problems (column 3, line 62 – column 4, line 28).

Engelsberg (5,024,968) teaches that chemical cleaning may introduce new contaminants, not only remove them (column 1, lines 43-46) and recommends application of laser energy to remove contaminants (column 2, line 46, column 3, line 26).

Engelsberg (Laser-Assisted Cleaning Proves Promising) teaches the use of application of laser energy to remove organic films (Selective Applications, page 157).

Elliott et al (WO 95/07152) teach removal of hard to remove photoresists by laser energy (page 1, lines 24-28, page 6, line 15 – page 7, line 2).

It would have been obvious to an ordinary artisan at the time the invention was made to use laser processing in the method of Gupta et al after the solvent rinse with reasonable expectation of success in order to more completely remove contamination, because the prior art teaches such step as a conventional for removal of photoresists and organic films, desirable and capable of removing contaminants, which may remain on the substrates after wet cleaning.

The use of ultrasonic/megasonic during liquid treatment of semiconductor wafers was notoriously well-known and conventional in the art to enhance the treatment. See at least Mayer et al.

It would have been obvious to an ordinary artisan at the time the invention was made to use ultrasonic/megasonic in the method of Gupta et al in order to enhance solvent treatment, because such enhancement was conventional in the industry.

(10) Response to Argument

The Appellants allege that the examiner has not cited references related to step (b), which is UV treatment.

The examiner disagrees:

Gupta et al teach application of sulfur trioxide to a photoresist to which UV radiation was applied. See at least column 5, lines 22-32, column 2, lines 39-49 and Description of the Related art.

It is noted that the Appellants argue that there is no disclosure by Gupta et al that the UV radiation used to cure the photoresists might also be capable of facilitating the reaction of sulfur trioxide with organic material to be removed.

This is not persuasive because claims merely require subjecting the substrate to a precursor treatment (UV radiation) capable of facilitating the reaction. Gupta et al teach application of UV radiation and teach the reaction of sulfur trioxide with the organic material (photoresist) to remove the organic material. The claims neither recite specifics of the UV radiation, nor require any specific extend of the action of the radiation.

The claims require application of UV prior to the step of treatment with sulfur trioxide. Such is disclosed by Gupta et al.

The Appellants allege that the step of UV treatment is conducted in a precursor treatment chamber. The Appellants further allege that curing of photoresists would not take place in a precursor treatment chamber.

The examiner would like to note that the claims are not limited for the argued limitation. There is no requirement in the claims to conduct application of UV in a pre-cursor chamber. Thereby the argument is not persuasive. The examiner again would like to point out that the claims require application of UV prior to the step of treatment with sulfur trioxide and that such is disclosed by Gupta et al.

With respect to the documents applied to modify the teaching of Gupta et al to provide the laser treatment, the Appellants argue that they could find no mention of a solvent rinse preceding the laser treatment. The appellants further argue that none of the applied documents discloses or suggests that their teachings can be employed in a sulfur trioxide process for removing photoresists.

The examiner disagrees:

The cited documents teach that chemical and wet treatments may be insufficient to remove all contaminants and/or all photoresists.

Nachshon teaches that residual photoresist contamination may exist after chemical removal of the photoresists (column 1, lines 55-64) and teaches removal of photoresists by pulsed laser (column 2, line 33 – column 3, line 60). Nachshon teaches that laser cleaning can be conducted after, before or during the reactive cleaning (column 3, lines 52-56).

Livshits et al (WO 97/17164) teach that methods of wet and dry stripping of photoresists, including the stripping with organic solvents, are not complete and may cause contamination (page 1, last paragraph – page 3 first paragraph). Livshits et al teach application of laser energy to remove photoresists (column 4, last paragraph - column 5, first two paragraphs, Summary of the Invention).

Engelsberg et al (5,531,857) that wet chemical cleaning fails to completely remove particulates (column 1, lines 56-59) and teach application of laser energy to solve the problem (Summary of the Invention).

Engelsberg et al (5,643,472) teach that wet and vapor cleaning methods have several drawbacks including inability to remove small particles (column 2, lines 50-56) and teach application of laser energy to solve the problems (column 3, line 62 – column 4, line 28).

Engelsberg (5,024,968) teaches that chemical cleaning may introduce new contaminants, not only remove previously presented contaminants (column 1, lines 43-46) and recommends application of laser energy to remove contaminants (column 2, line 46, column 3, line 26).

Engelsberg (Laser-Assisted Cleaning Proves Promising) teaches the use of application of laser energy to remove organic films (Selective Applications, page 157).

Elliott et al (WO 95/07152) teach removal of hard to remove photoresists by laser energy (page 1, lines 24-28, page 6, line 15 – page 7, line 2).

The examiner's position is that having the teachings of the cited documents, it would have been obvious to an ordinary artisan at the time the invention was

made to use laser processing in the method of Gupta et al after the sulfur trioxide cleaning and solvent rinse (chemical and wet treatments) with reasonable expectation of success in order to more completely remove contamination, because the prior art teaches such step as a conventional for removal of photoresists and organic films, desirable and capable of removing contaminants, which may remain on the substrates after wet cleaning. Gupta et al teach a chemical treatment, which is followed by a wet treatment. The other cited documents teach that chemical and wet treatments may be insufficient to remove all contaminants and/or all photoresists.

An ordinary artisan would have been reasonably expected that the laser treatment would improve the results of treatment disclosed by Gupta et al.

The Appellants allege that the examiner did not consider the claims as a whole.

The examiner disagrees. All claimed limitations were considered and the claims were considered as a whole.

The Appellants argue that they recognized that sulfur trioxide would not necessarily completely remove photoresists and that pre-treatment and/or post-treatment will help to remove anything not removed by sulfur trioxide.

The examiner would like to again note that Gupta et al teach application of UV as claimed and that the other cited documents teach that chemical and wet treatment may be insufficient to remove all contaminants and/or all photoresists and recommend application of laser energy to obviate the problem.

With respect to the Appellants' arguments directed to application of the teaching of Mayer et al to modify Gupta et al to use ultrasonic/megasonic to enhance liquid treatment of Gupta et al:

The examiner would like to emphasize that the referenced step is optional and thereby is not required.

The examiner, however, would like to respond to the Appellants' arguments.

The Appellants argue that no suggestion in Mayer et al that the ultrasonic/megasonic treatment would be useful in the specific sequence recited by the claims.

This is not persuasive. The teaching of Mayer et al was used to show that it was known in the art to enhance liquid cleaning by application of ultrasonic/megasonic. The examiner's position is that it would have been obvious to an ordinary artisan at the time the invention was made to enhance the liquid cleaning steps of Gupta by application of ultrasonic/megasonic. Such obvious modification of the method of Gupta would meet the claimed limitations.

The Appellants argue that step (d) is preceded by exposure to sulfur trioxide and is followed by a solvent rinse.

The Appellants allege that such sequence is not disclosed or suggested by the cited references.

The examiner would like to note that in contrast to the Appellants' statement the claims are not limited to argued sequence. The mere naming the step "pre-rinse" does not require any specific sequence for this step.

Further, even if the argued sequence is required, the applied combination would provide the argued sequence. This is because Gupta et al teach repeating of the step of rinsing (at least claim 9 of Gupta et al). Repeating of rinsing treatments of the method of Gupta et al modified to be enhanced by ultrasonic/megasonic would meet the argued sequence. This is because the first megasonically/ultrasonically enhanced rinsing would be conducted prior to the second megasonically/ultrasonically enhanced rinsing. The claims do not exclude the use of megasonic/ultrasonic during solvent rinsing.

The Appellants argue that Mayer et al do not teach conducting ultrasonic/megasonic in conjunction with sulfur trioxide cleaning.

The examiner would like to note that the claimed method does not require application of ultrasonic/megasonic during sulfur trioxide cleaning.

The examiner would like to further note that method of Gupta et al includes rinsing with water or other solvents. Mayer et al teach enhancement of rinsing and cleaning by application of ultrasonic/megasonic.

It would have been obvious to an ordinary artisan at the time the invention was made to enhance the rinsing step of Gupta et al by the ultrasonic/megasonic as recommended by Mayer et al.

It is also noted that Mayer et al teach application of ultrasonic/megasonic in processes of photoresists stripping (at least at column 5, lines 41-46). The method of Gupta et al is a method for photoresist stripping.

Considering the above it would have been obvious to an ordinary artisan at the time the invention was made to enhance the solvent rinsing disclosed by Gupta et al by action of ultrasonic/megasonic in order to obtain better cleaning/rinsing results.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Alexander Markoff/

Primary Examiner, Art Unit 1792

Conferees:

/Michael Barr/

Supervisory Patent Examiner, Art Unit 1792

/Gregory L Mills/

Supervisory Patent Examiner, Art Unit 1700